

What is claimed:

1. A defrostable ventilation apparatus, for exchanging air between the interior and exterior of a building, for transferring water moisture and sensible heat between exhaust air taken from the building and fresh air taken from the exterior ambient air for delivery to the building, and wherein air from the interior of the building is used as defrost air to defrost the ventilation apparatus, said ventilation apparatus having fresh air path means having a fresh air intake side and a fresh air discharge side, exhaust air path means having an exhaust air intake side and an exhaust air discharge side, a rotary exchanger wheel for transfer of water moisture and sensible heat between said exhaust air and said fresh air, said exchanger wheel being configured and rotatably disposed so as to define a first air stream path and a second air stream path, said first air stream path defining a portion of said fresh air path means between the fresh air intake side and the fresh air discharge side thereof and said second air stream path defining a portion of said exhaust air path means between the exhaust air intake side and the exhaust air discharge side thereof, and a ventilation rotation component for inducing, during a ventilation cycle, ventilation rotation of said exchanger wheel through said fresh air path means and said exhaust air path means, characterized in that said apparatus comprises defrost air path means for conveying defrost air to said fresh air intake side, said defrost

air path means being configured to connect the exhaust air discharge side with the fresh air intake side for conveying defrost air to said fresh air intake side from said exhaust air discharge side,

a damper component, said damper component being displaceable between a ventilation configuration for a ventilation cycle

wherein said defrost air path means is closed off and said fresh air intake side and exhaust air discharge side are open,

and a defrost configuration for a defrost cycle

wherein said fresh air intake side and said exhaust air discharge side are closed off and said defrost air path means is open,

and

a defrost rotation component for inducing, during a defrost cycle, said rotary exchanger wheel to rotate at a defrost rotation speed of from 0 to 2 rpm through said fresh air path means and said exhaust air path means,

and wherein

during a ventilation cycle, when said damper component is in said ventilation configuration,

fresh air is able to flow through said fresh air path means and exhaust air is able to flow through said exhaust air path means,

and

during a defrost cycle, when said damper component is in said defrost configuration,

defrost air taken from the building, is able to circulate, for delivery back into the building, through said exhaust air intake side, through said second air stream path, then through said defrost air path means, through said first air stream path,

[illegible]

3. A ventilation apparatus as defined in claim 1  
wherein said damper component comprises a first damper component and a second  
damper component,  
said first damper component being displaceable between

wherein said defrost air path means is closed off and said fresh air intake side is open and

wherein said defrost air path means is open and said fresh air intake side is closed off

a ventilation configuration

a defrost configuration

and wherein

68

fresh air is able to flow through said fresh air path means and exhaust air is able to flow through said exhaust air path means,

and

during a defrost cycle, when said first and second damper components are in said respective defrost configurations,

defrost air taken from the building, is able to circulate, for delivery back into the building, through said exhaust air intake side, through said second air stream path, then through said defrost air path means, through said first air stream path, and through said fresh air discharge side.

4. The ventilation apparatus as defined in claim 3

wherein said fresh air path means, said exhaust air path means, said rotary exchanger wheel, and said defrost air path means, are disposed in a cabinet,

wherein said fresh air intake side, said exhaust air discharge side, said fresh air discharge side and said exhaust air intake side each includes one respective air opening in an outer wall of said cabinet,

wherein a partition wall in said cabinet separates said exhaust air discharge side from said fresh air intake side,

and

wherein said defrost air path means comprises an opening in said partition wall.

5. A ventilation apparatus as defined in claim 4 wherein said apparatus includes a fan component mounted in said cabinet for moving fresh air through said fresh air path means and for moving exhaust air through said exhaust air path means, said fan

component comprising one electric motor and two blower wheels operatively connected thereto, said fresh air path means including one said blower wheel and said exhaust path means including the other said blower wheel.

6. A defrostable ventilation apparatus, for exchanging air between the interior and exterior of a building, for transferring water moisture and sensible heat between exhaust air taken from the building and fresh air taken from the exterior ambient air for delivery to the building, and wherein air from the interior of the building is used as defrost air to defrost the ventilation apparatus, said ventilation apparatus having fresh air path means having a fresh air intake side and a fresh air discharge side, exhaust air path means having an exhaust air intake side and an exhaust air discharge side, a rotary exchanger wheel for transfer of water moisture and sensible heat between said exhaust air and said fresh air, said exchanger wheel being configured and rotatably disposed so as to define a first air stream path and a second air stream path, said first air stream path defining a portion of said fresh air path means between the fresh air intake side and the fresh air discharge side thereof and said second air stream path defining a portion of said exhaust air path means between the exhaust air intake side and the exhaust air discharge side thereof, and a ventilation rotation component for inducing, during a ventilation cycle, ventilation rotation of said exchanger wheel through said fresh air path means and said exhaust air path means,

characterized in that said apparatus comprises

defrost air path means for conveying defrost air to said fresh air intake side, said defrost air path means being configured to connect the exhaust air discharge side with the fresh air intake side for conveying defrost air to said fresh air intake side from said exhaust air discharge side,

and

a damper component, said damper component being displaceable between a ventilation configuration for a ventilation cycle

wherein said defrost air path means is closed off and said fresh air intake side and exhaust air discharge side are open,

and a defrost configuration for a defrost cycle

wherein said fresh air intake side and said exhaust air discharge side are closed off, and said defrost air path means is open,

a component for stopping, during a defrost cycle, said rotary exchanger wheel from rotating,

and wherein

during a ventilation cycle, when said damper means is in said ventilation configuration,

fresh air is able to flow through said fresh air path means and exhaust air is able to flow through said exhaust air path means,

and

during a defrost cycle, when said damper means is in said defrost configuration,

defrost air taken from the building, is able to circulate, for delivery back into the building, through said exhaust air intake side, through said second air stream path, then through said defrost air path means, through said first air stream path,

and through said fresh air discharge side.

7. A ventilation apparatus as defined in claim 6 wherein said ventilation rotation component comprises an electric motor and said component for stopping the rotation of said exchanger wheel comprises an electric switch configured so as to be able to de-energize said motor during a defrost cycle.

8. A ventilation apparatus as defined in claim 6 wherein said fresh air path means includes a fan for moving fresh air through said fresh air path means and said exhaust air means includes a fan for moving exhaust air through said exhaust air path means.

9. A ventilation apparatus as defined in claim 6 wherein said damper component comprises a first damper component and a second damper component, said first damper component being displaceable between

a ventilation configuration

wherein said defrost air path means is closed off and said fresh air intake side is open and

a defrost configuration

wherein said defrost air path means is open and said fresh air intake side is closed off

and said second damper component being displaceable between

a ventilation configuration

wherein said exhaust air discharge side is open and

Project	Start Date	End Date	Duration	Project Manager	Status	Comments
Project A	2023-01-01	2023-03-15	75 days	John Doe	Completed	On time, within budget.
Project B	2023-02-01	2023-04-30	90 days	Jane Smith	In Progress	Minor delays, budget OK.
Project C	2023-03-01	2023-05-15	75 days	Mike Johnson	On Hold	Waiting for client feedback.
Project D	2023-04-01	2023-06-30	90 days	Sarah Lee	Planned	Initial planning phase.
Project E	2023-05-01	2023-07-15	75 days	David Kim	On Hold	Resource allocation pending.
Project F	2023-06-01	2023-08-31	92 days	Emily White	Planned	Scope definition in progress.
Project G	2023-07-01	2023-09-15	77 days	Chris Brown	On Hold	Client onboarding delayed.
Project H	2023-08-01	2023-10-31	92 days	Alex Green	Planned	Market research ongoing.
Project I	2023-09-01	2023-11-15	75 days	Mia Black	On Hold	Legal review required.
Project J	2023-10-01	2023-12-31	91 days	Noah Grey	Planned	Final budget review.

and wherein

fresh air is able to flow through said fresh air path means and exhaust is able to flow through said exhaust air path means,

during a defrost cycle, when said first and second damper components are in said respective defrost configurations,

defrost air taken from the building, is able to circulate, for delivery back into the building, through said exhaust air intake side, through said second air stream path, then through said defrost air path means, through said first air stream path, and through said fresh air discharge side, .

wherein said fresh air path means, said exhaust air path means, said rotary exchanger wheel, and said defrost air path means, are disposed in a cabinet,

wherein said fresh air intake side, said exhaust air discharge side, said fresh air discharge side and said exhaust air intake side each includes one respective air opening in an outer wall of said cabinet,

wherein a partition wall in said cabinet separates said exhaust air discharge side from said fresh air intake side,

73



- i) directing exhaust air to flow through said second air path and then through said first air path back into said building, and
- ii) stopping the rotation of said exchanger wheel such that said rotary exchanger wheel is able to be defrosted by said exhaust air.

14. A defrostable ventilation apparatus, for exchanging air between the interior and exterior of a building, for transferring water moisture and sensible heat between exhaust air taken from the building and fresh air taken from the exterior ambient air for delivery to the building, and wherein air from the interior of the building is used as defrost air to defrost the ventilation apparatus, said ventilation apparatus having fresh air path means having a fresh air intake side and a fresh air discharge side, exhaust air path means having an exhaust air intake side and an exhaust air discharge side,

a rotary exchanger wheel for transfer of water moisture and sensible heat between said exhaust air and said fresh air,

said exchanger wheel being configured and rotatably disposed so as to define a first air stream path and a second air stream path,

said first air stream path defining a portion of said fresh air path means between the fresh air intake side and the fresh air discharge side thereof and said second air stream path defining a portion of said exhaust air path means between the exhaust air intake side and the exhaust air discharge side thereof,

and

a rotation component for inducing rotation of said exchanger wheel through said fresh air path means and said exhaust air path means,

Figure 1. The effect of the concentration of the *Agaricus bisporus* spores on the growth of *Agaricus bisporus* and *Agaricus bisporus* spores. The concentration of the spores was 10<sup>6</sup> spores/ml (a), 10<sup>7</sup> spores/ml (b), 10<sup>8</sup> spores/ml (c), 10<sup>9</sup> spores/ml (d), 10<sup>10</sup> spores/ml (e), 10<sup>11</sup> spores/ml (f), 10<sup>12</sup> spores/ml (g), 10<sup>13</sup> spores/ml (h), 10<sup>14</sup> spores/ml (i), 10<sup>15</sup> spores/ml (j), 10<sup>16</sup> spores/ml (k), 10<sup>17</sup> spores/ml (l), 10<sup>18</sup> spores/ml (m), 10<sup>19</sup> spores/ml (n), 10<sup>20</sup> spores/ml (o), 10<sup>21</sup> spores/ml (p), 10<sup>22</sup> spores/ml (q), 10<sup>23</sup> spores/ml (r), 10<sup>24</sup> spores/ml (s), 10<sup>25</sup> spores/ml (t), 10<sup>26</sup> spores/ml (u), 10<sup>27</sup> spores/ml (v), 10<sup>28</sup> spores/ml (w), 10<sup>29</sup> spores/ml (x), 10<sup>30</sup> spores/ml (y), 10<sup>31</sup> spores/ml (z), 10<sup>32</sup> spores/ml (aa), 10<sup>33</sup> spores/ml (ab), 10<sup>34</sup> spores/ml (ac), 10<sup>35</sup> spores/ml (ad), 10<sup>36</sup> spores/ml (ae), 10<sup>37</sup> spores/ml (af), 10<sup>38</sup> spores/ml (ag), 10<sup>39</sup> spores/ml (ah), 10<sup>40</sup> spores/ml (ai), 10<sup>41</sup> spores/ml (aj), 10<sup>42</sup> spores/ml (ak), 10<sup>43</sup> spores/ml (al), 10<sup>44</sup> spores/ml (am), 10<sup>45</sup> spores/ml (an), 10<sup>46</sup> spores/ml (ao), 10<sup>47</sup> spores/ml (ap), 10<sup>48</sup> spores/ml (aq), 10<sup>49</sup> spores/ml (ar), 10<sup>50</sup> spores/ml (as), 10<sup>51</sup> spores/ml (at), 10<sup>52</sup> spores/ml (au), 10<sup>53</sup> spores/ml (av), 10<sup>54</sup> spores/ml (aw), 10<sup>55</sup> spores/ml (ax), 10<sup>56</sup> spores/ml (ay), 10<sup>57</sup> spores/ml (az), 10<sup>58</sup> spores/ml (ba), 10<sup>59</sup> spores/ml (bb), 10<sup>60</sup> spores/ml (bc), 10<sup>61</sup> spores/ml (bd), 10<sup>62</sup> spores/ml (be), 10<sup>63</sup> spores/ml (bf), 10<sup>64</sup> spores/ml (bg), 10<sup>65</sup> spores/ml (bh), 10<sup>66</sup> spores/ml (bi), 10<sup>67</sup> spores/ml (bj), 10<sup>68</sup> spores/ml (bk), 10<sup>69</sup> spores/ml (bl), 10<sup>70</sup> spores/ml (bm), 10<sup>71</sup> spores/ml (bn), 10<sup>72</sup> spores/ml (bo), 10<sup>73</sup> spores/ml (bp), 10<sup>74</sup> spores/ml (bq), 10<sup>75</sup> spores/ml (br), 10<sup>76</sup> spores/ml (bs), 10<sup>77</sup> spores/ml (bt), 10<sup>78</sup> spores/ml (bu), 10<sup>79</sup> spores/ml (bv), 10<sup>80</sup> spores/ml (bw), 10<sup>81</sup> spores/ml (bx), 10<sup>82</sup> spores/ml (by), 10<sup>83</sup> spores/ml (bz), 10<sup>84</sup> spores/ml (ca), 10<sup>85</sup> spores/ml (cb), 10<sup>86</sup> spores/ml (cc), 10<sup>87</sup> spores/ml (cd), 10<sup>88</sup> spores/ml (ce), 10<sup>89</sup> spores/ml (cf), 10<sup>90</sup> spores/ml (cg), 10<sup>91</sup> spores/ml (ch), 10<sup>92</sup> spores/ml (ci), 10<sup>93</sup> spores/ml (cj), 10<sup>94</sup> spores/ml (ck), 10<sup>95</sup> spores/ml (cl), 10<sup>96</sup> spores/ml (cm), 10<sup>97</sup> spores/ml (cn), 10<sup>98</sup> spores/ml (co), 10<sup>99</sup> spores/ml (cp), 10<sup>100</sup> spores/ml (cq), 10<sup>101</sup> spores/ml (cr), 10<sup>102</sup> spores/ml (cs), 10<sup>103</sup> spores/ml (ct), 10<sup>104</sup> spores/ml (cu), 10<sup>105</sup> spores/ml (cv), 10<sup>106</sup> spores/ml (cw), 10<sup>107</sup> spores/ml (cx), 10<sup>108</sup> spores/ml (cy), 10<sup>109</sup> spores/ml (cz), 10<sup>110</sup> spores/ml (da), 10<sup>111</sup> spores/ml (db), 10<sup>112</sup> spores/ml (dc), 10<sup>113</sup> spores/ml (dd), 10<sup>114</sup> spores/ml (de), 10<sup>115</sup> spores/ml (df), 10<sup>116</sup> spores/ml (dg), 10<sup>117</sup> spores/ml (dh), 10<sup>118</sup> spores/ml (di), 10<sup>119</sup> spores/ml (dj), 10<sup>120</sup> spores/ml (dk), 10<sup>121</sup> spores/ml (dl), 10<sup>122</sup> spores/ml (dm), 10<sup>123</sup> spores/ml (dn), 10<sup>124</sup> spores/ml (do), 10<sup>125</sup> spores/ml (dp), 10<sup>126</sup> spores/ml (dq), 10<sup>127</sup> spores/ml (dr), 10<sup>128</sup> spores/ml (ds), 10<sup>129</sup> spores/ml (dt), 10<sup>130</sup> spores/ml (du), 10<sup>131</sup> spores/ml (dv), 10<sup>132</sup> spores/ml (dw), 10<sup>133</sup> spores/ml (dx), 10<sup>134</sup> spores/ml (dy), 10<sup>135</sup> spores/ml (dz), 10<sup>136</sup> spores/ml (ea), 10<sup>137</sup> spores/ml (eb), 10<sup>138</sup> spores/ml (ec), 10<sup>139</sup> spores/ml (ed), 10<sup>140</sup> spores/ml (ee), 10<sup>141</sup> spores/ml (ef), 10<sup>142</sup> spores/ml (eg), 10<sup>143</sup> spores/ml (eh), 10<sup>144</sup> spores/ml (ei), 10<sup>145</sup> spores/ml (ej), 10<sup>146</sup> spores/ml (ek), 10<sup>147</sup> spores/ml (el), 10<sup>148</sup> spores/ml (em), 10<sup>149</sup> spores/ml (en), 10<sup>150</sup> spores/ml (eo), 10<sup>151</sup> spores/ml (ep), 10<sup>152</sup> spores/ml (eq), 10<sup>153</sup> spores/ml (er), 10<sup>154</sup> spores/ml (es), 10<sup>155</sup> spores/ml (et), 10<sup>156</sup> spores/ml (eu), 10<sup>157</sup> spores/ml (ev), 10<sup>158</sup> spores/ml (ew), 10<sup>159</sup> spores/ml (ex), 10<sup>160</sup> spores/ml (ey), 10<sup>161</sup> spores/ml (ez), 10<sup>162</sup> spores/ml (fa), 10<sup>163</sup> spores/ml (fb), 10<sup>164</sup> spores/ml (fc), 10<sup>165</sup> spores/ml (fd), 10<sup>166</sup> spores/ml (fe), 10<sup>167</sup> spores/ml (ff), 10<sup>168</sup> spores/ml (fg), 10<sup>169</sup> spores/ml (fh), 10<sup>170</sup> spores/ml (fi), 10<sup>171</sup> spores/ml (fj), 10<sup>172</sup> spores/ml (fk), 10<sup>173</sup> spores/ml (fl), 10<sup>174</sup> spores/ml (fm), 10<sup>175</sup> spores/ml (fn), 10<sup>176</sup> spores/ml (fo), 10<sup>177</sup> spores/ml (fp), 10<sup>178</sup> spores/ml (fq), 10<sup>179</sup> spores/ml (fr), 10<sup>180</sup> spores/ml (fs), 10<sup>181</sup> spores/ml (ft), 10<sup>182</sup> spores/ml (fu), 10<sup>183</sup> spores/ml (fv), 10<sup>184</sup> spores/ml (fw), 10<sup>185</sup> spores/ml (fx), 10<sup>186</sup> spores/ml (fy), 10<sup>187</sup> spores/ml (fz), 10<sup>188</sup> spores/ml (ga), 10<sup>189</sup> spores/ml (gb), 10<sup>190</sup> spores/ml (gc), 10<sup>191</sup> spores/ml (gd), 10<sup>192</sup> spores/ml (ge), 10<sup>193</sup> spores/ml (gf), 10<sup>194</sup> spores/ml (gg), 10<sup>195</sup> spores/ml (gh), 10<sup>196</sup> spores/ml (gi), 10<sup>197</sup> spores/ml (gj), 10<sup>198</sup> spores/ml (gk), 10<sup>199</sup> spores/ml (gl), 10<sup>200</sup> spores/ml (gm), 10<sup>201</sup> spores/ml (gn), 10<sup>202</sup> spores/ml (go), 10<sup>203</sup> spores/ml (gp), 10<sup>204</sup> spores/ml (gq), 10<sup>205</sup> spores/ml (gr), 10<sup>206</sup> spores/ml (gs), 10<sup>207</sup> spores/ml (gt), 10<sup>208</sup> spores/ml (gu), 10<sup>209</sup> spores/ml (gv), 10<sup>210</sup> spores/ml (gw), 10<sup>211</sup> spores/ml (gx), 10<sup>212</sup> spores/ml (gy), 10<sup>213</sup> spores/ml (gz), 10<sup>214</sup> spores/ml (ha), 10<sup>215</sup> spores/ml (hb), 10<sup>216</sup> spores/ml (hc), 10<sup>217</sup> spores/ml (hd), 10<sup>218</sup> spores/ml (he), 10<sup>219</sup> spores/ml (hf), 10<sup>220</sup> spores/ml (hg), 10<sup>221</sup> spores/ml (hh), 10<sup>222</sup> spores/ml (hi), 10<sup>223</sup> spores/ml (hj), 10<sup>224</sup> spores/ml (hk), 10<sup>225</sup> spores/ml (hl), 10<sup>226</sup> spores/ml (hm), 10<sup>227</sup> spores/ml (hn), 10<sup>228</sup> spores/ml (ho), 10<sup>229</sup> spores/ml (hp), 10<sup>230</sup> spores/ml (hq), 10<sup>231</sup> spores/ml (hr), 10<sup>232</sup> spores/ml (hs), 10<sup>233</sup> spores/ml (ht), 10<sup>234</sup> spores/ml (hu),

and

wherein said defrost air path means is closed off and said fresh air intake side and said exhaust air discharge side are open,

wherein said fresh air intake side and said exhaust air discharge side are closed off and said defrost air path means is open,

during a ventilation cycle, when said damper component is in said ventilation configuration,

and

76

discharge side.

15. A defrostable ventilation apparatus, for exchanging air between the interior and exterior of a building, for transferring water moisture and sensible heat between exhaust air taken from the building and fresh air taken from the exterior ambient air for delivery to the building, and wherein air from the interior of the building is used as defrost air to defrost the ventilation apparatus, said ventilation apparatus having fresh air path means having a fresh air intake side and a fresh air discharge side, exhaust air path means having an exhaust air intake side and an exhaust air discharge side, a rotary exchanger wheel for transfer of water moisture and sensible heat between said exhaust air and said fresh air, said exchanger wheel being configured and rotatably disposed so as to define a first air stream path and a second air stream path, said first air stream path defining a portion of said fresh air path means between the fresh air intake side and the fresh air discharge side thereof and said second air stream path defining a portion of said exhaust air path means between the exhaust air intake side and the exhaust air discharge side thereof, and a rotation component for inducing rotation of said exchanger wheel through said fresh air path means and said exhaust air path means, characterized in that said apparatus comprises defrost air path means for providing an air path by-passing said first air steam path, said defrost air path means being configured to connect the exhaust air discharge side with

the fresh air discharge side for conveying defrost air to said fresh air discharge side from said exhaust air discharge side,

and

a damper component, said damper component being displaceable between a ventilation configuration for a ventilation cycle

wherein said defrost air path means is closed off and said fresh air intake side and exhaust air discharge side are open,

and a defrost configuration for a defrost cycle

wherein said fresh air intake side and said exhaust air discharge side are closed off, and said defrost air path means is open,

and wherein

during a ventilation cycle, when said damper component is in said ventilation configuration,

fresh air is able to flow through said fresh air path means and exhaust air is able to flow through said exhaust air path means,

and

during a defrost cycle, when said damper component is in said defrost configuration,

defrost air taken from the building, is able to circulate, for delivery back into the building, through said exhaust air intake side, through said second air stream path, then through said defrost air path means, and through said fresh air discharge side.

16. A ventilation apparatus, for exchanging air between the interior and exterior of a building, and for transferring, a member of the group comprising i) sensible heat and

000000277-112001

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808 2809 2810 2811 2812 2813 2814 2815 2816 2817 2

exhaust air path means having an exhaust air intake side and an exhaust air discharge side,

said first air stream path defining a portion of the fresh air path means between the fresh air intake side and the fresh air discharge side thereof and said second air stream path defining a portion of said exhaust air path means between the exhaust air intake side and the exhaust air discharge side thereof,

first, second, third and fourth static pressure taps,

said third and fourth static pressure taps being configured and disposed for the determination of a second static pressure difference therebetween in said exhaust air

path means, said second air stream path being disposed between said third and fourth static pressure taps.

17. A ventilation apparatus as defined in claim 16 wherein said apparatus comprises a first adjustable damper component for adjusting air flow through said fresh air path means, and a second adjustable damper component for adjusting air flow through said exhaust air path means.

18. A ventilation apparatus as defined in claim 17 wherein said first adjustable damper component is disposed on the fresh air discharge side of said fresh air path means, and said second adjustable damper component is disposed on the exhaust air intake side of said exhaust air path means.

19. A ventilation apparatus as defined in claim 16 wherein said first and second pressure taps each comprise a pressure sampling aperture defined by a wall of said fresh air path means and wherein said third and fourth pressure taps each comprise a pressure sampling apertures defined by a wall of said exhaust air path means.

20. A ventilation apparatus as defined in claim 16 wherein said apparatus includes a fan component for forcing air to pass through said first and second air stream paths.

21. A ventilation apparatus as defined in claim 16 wherein said ventilation apparatus

Figure 1. The structure of the proposed model. The model is composed of three main parts: the input layer, the hidden layer, and the output layer. The input layer consists of 10 nodes, representing the input features. The hidden layer consists of 10 nodes, representing the hidden features. The output layer consists of 10 nodes, representing the output features. The model is trained using a supervised learning algorithm, where the input features are used to predict the output features. The model is evaluated using a set of test data, and the performance is measured using the mean squared error (MSE) and the coefficient of determination (R-squared).

23. A ventilation apparatus as defined in claim 16 wherein said exchanger comprises a rotary exchanger wheel for exchanging sensible heat and water moisture.

25. A ventilation apparatus as defined in claim 24 wherein said sensible heat exchanger is of a rectangular parallelepiped shape, the first and second air paths thereof are disposed at right angles to each other and said sensible heat exchanger element is so disposed such that the first and second air paths are diagonally oriented so that they are self draining.

81

and wherein said third and fourth pressure tap means each comprise a pressure sampling apertures defined by a wall of said exhaust air path means.

27. A ventilation apparatus as defined in claim 26 wherein said fresh air path means comprises a wall of said cabinet which defines said apertures of said first and second pressure tap means, wherein said exhaust air path means comprises a wall of said cabinet which defines said apertures of said third and fourth pressure tap means.

28. A ventilation apparatus as defined in claim 27 wherein said apparatus comprises a first adjustable damper component for adjusting air flow through said fresh air path means, and a second adjustable damper component for adjusting air flow through said exhaust air path means.

29. A ventilation apparatus as defined in claim 28 wherein said first adjustable damper component is disposed on the fresh air discharge side of said fresh air path means, and said second adjustable damper component is disposed on the exhaust air intake side of said exhaust air path means.

30. A ventilation apparatus as defined in claim 29 wherein said exchanger means comprises a rotary exchanger wheel.

31. A ventilation apparatus as defined in claim 30 wherein said apparatus includes a fan component for forcing air to pass through said first and second air stream paths.

32. A method for balancing fresh air and exhaust air flow through an operating ventilation apparatus,  
said ventilation apparatus being configured for exchanging air between the interior and exterior of a building and for transferring, a member of the group comprising i) sensible heat and ii) sensible heat and water moisture, between exhaust air taken from the building and fresh air taken from the exterior ambient air for delivery to the building,  
said ventilation apparatus comprising

fresh air path means having a fresh air intake side and a fresh air discharge side,

exhaust air path means having an exhaust air intake side and an exhaust air discharge side,

an exchanger for exchanging, a member selected from the group comprising i) sensible heat and ii) sensible heat and water moisture, between fresh air and exhaust air, said exchanger means being configured and disposed so as to define a first air stream path and a second air stream path,

said first air stream path defining a portion of the fresh air path means between the fresh air intake side and the fresh air discharge side thereof and said second air stream path defining a portion of said exhaust air path means between the exhaust air intake side and the exhaust air discharge side thereof,

said method comprising

determining a first static pressure difference in said fresh air path means, said first static pressure difference being determined with respect to first and second static pressure sampling locations, said first air stream path being disposed between said first and second static pressure sampling locations,

determining a second static pressure difference in said exhaust air path means, said second static pressure difference being determined with respect to third and fourth static pressure sampling locations, said second air stream path being disposed between said third and fourth static pressure sampling locations,

comparing predetermined air flow values represented by each of said so obtained first and second static pressure differences so as to determine if said predetermined fresh air and exhaust air flow values are at least substantially the same.

33. A method as defined in claim 32, wherein said apparatus includes  
a first adjustable damper component for adjusting air flow through said fresh air path means, and  
a second adjustable damper component for adjusting air flow through said exhaust air path means.

34. A method as defined in claim 33, said method including manipulating at least one of said first and second damper components until said so obtained first and second static pressure differences are each set at a value whereby each static pressure difference represents a respective predetermined air flow value which is at least

substantially the same as the other.

35. A ventilation apparatus, for exchanging air between the interior and exterior of a building, and for transferring water moisture and sensible heat between exhaust air taken from the building and fresh air taken from the exterior ambient air for delivery to the building,

said ventilation apparatus comprising

fresh air path means having a fresh air intake side and a fresh air discharge side,

exhaust air path means having an exhaust air intake side and an exhaust air discharge side,

an exchanger comprising

a desiccant exchanger element for transfer of water moisture and sensible heat between said exhaust air and said fresh air,

and

a sensible heat exchanger element for transfer of sensible heat between said exhaust air and said fresh air,

said desiccant exchanger element comprising a rotary exchanger wheel configured and rotatably disposed so as to define a second air stream path and a third air stream path,

said second air stream path defining a portion of said fresh air path means and

said third air stream path defining a portion of said exhaust air path means,

said sensible heat exchanger element comprising

a first air path defining a portion of said fresh air path means and a fourth air

path defining a portion of said exhaust air path means,

said fresh air path means and said exhaust air path means being disposed and

configured such that during a ventilation cycle,

exhaust air entering the exhaust air intake side flows through said third air stream path and then through said fourth air stream path and

fresh entering said the fresh air intake side flows through said first air stream path and then through said second air stream path,

said ventilation apparatus including a rotation component for inducing rotation of said exchanger wheel through said fresh air path means and said exhaust air path means.

36. A ventilation apparatus as defined in claim 35 wherein said sensible heat exchanger element comprises air-to-air heat exchanging walls between said first and fourth air paths.

37. A ventilation apparatus as defined in claim 36 wherein said sensible heat exchanger element is of a rectangular parallelepiped shape, the first and fourth air paths thereof are disposed at right angles to each other and said sensible heat exchanger element is so disposed such that the first and fourth air paths are diagonally oriented so that they are self draining.

38. A ventilation apparatus as defined in claim 35 wherein said sensible heat exchanger element is a rotary sensible heat exchanger wheel configured and rotatably disposed so as to define said first and fourth air stream paths and said apparatus includes a rotation component for inducing rotation of said sensible heat exchanger wheel through said fresh air path means and said exhaust air path means.

[illegible]

- and**

said ventilation apparatus comprising

an exchanger comprising

87

[illegible]

a sensible heat exchanger element for transfer of sensible heat between  
said exhaust air and said fresh air,  
said desiccant exchanger element comprising a rotary exchanger wheel configured and  
rotatably disposed so as to define a second air stream path and a third air stream path,  
said second air stream path defining a portion of said fresh air path means and  
said third air stream path defining a portion of said exhaust air path means,  
said sensible heat exchanger element comprising

a first air path defining a portion of said fresh air path means and a fourth air path defining a portion of said exhaust air path means,

said first and second air stream paths defining respective portions of said fresh air path means between the intake and discharge sides of said fresh air path means,

said third and fourth air stream paths defining respective portions of said exhaust air path means between the intake and discharge sides of said exhaust air path means,

said fresh air path means and said exhaust air path means being disposed and configured such that during a ventilation cycle,

exhaust air entering the exhaust air intake side flows through said third air stream path and then through said fourth air stream path and fresh air entering said the fresh air intake side flows through said first air stream path and then through said second air stream path,

said ventilation apparatus including

88

[illegible]

a damper component, said damper component being displaceable between a ventilation configuration for a ventilation cycle

and a defrost configuration for a defrost cycle

and wherein

fresh air is able to flow through said fresh air path means and exhaust air is able to flow through said exhaust air path means,

during a defrost cycle, when said damper component is in said defrost configuration, defrost air taken from the building, is able to circulate, for delivery back into the building, through said exhaust air intake side, through said third air stream path, through said fourth air stream path, then through said defrost air path means,

through said first air stream path, through said second air stream path and through said fresh air discharge side.

41. A ventilation apparatus as defined in claim 40 including a defrost rotation component for inducing, during a defrost cycle, said rotary exchanger wheel to rotate at a rotational speed of from 0 to 2 rpm.

42. A ventilation apparatus as defined in claim 40 including a component for stopping, during a defrost cycle, said rotary exchanger wheel from rotating.

43. A ventilation apparatus as defined in claim 42 wherein said rotation component comprises an electric motor and said component for stopping the rotation of said exchanger wheel comprises an electric switch configured so as to be able to de-energize said motor during a defrost cycle.

44. A ventilation apparatus as defined in claim 40 wherein said sensible heat exchanger element comprises air-to-air heat exchanging walls between said first and fourth air paths.

45. A ventilation apparatus as defined in claim 44 wherein said sensible heat exchanger element is of a rectangular parallelepiped shape, the first and fourth air paths thereof are disposed at right angles to each other and said sensible heat exchanger element is so disposed such that the first and fourth air paths are diagonally oriented so that they are self draining.



wherein said exhaust air discharge side is closed off,  
and wherein  
during a ventilation cycle, when said first and second damper components are in said  
respective ventilation configurations;

fresh air is able to flow through said fresh air path means and exhaust is able to  
flow through said exhaust air path means,

and

during a defrost cycle, when said first and second damper components are in said  
respective defrost configurations,

defrost air taken from the building, is able to circulate, for delivery back into the  
building, through said exhaust air intake side, through said second air stream  
path, then through said defrost air path means, through said first air stream path,  
and through said fresh air discharge side.

49. The ventilation apparatus as defined in claim 48

wherein said fresh air path means, said exhaust air path means, said rotary exchanger  
wheel, and said defrost air path means, are disposed in a cabinet,

wherein said fresh air intake side, said exhaust air discharge side, said fresh air  
discharge side and said exhaust air intake side each includes one respective air opening  
in an outer wall of said cabinet,

wherein a partition wall in said cabinet separates said exhaust air discharge side with  
said fresh air intake side,

and

wherein said defrost air path means comprises an opening in said partition wall.



00000277-112001

said second air stream path defining a portion of said fresh air path means and  
said third air stream path defining a portion of said exhaust air path means,  
said sensible heat exchanger element comprising

a first air path defining a portion of said fresh air path means and a fourth air  
path defining a portion of said exhaust air path means,  
said first and second air stream paths defining respective portions of said fresh air path  
means between the intake and discharge sides of said fresh air path means,  
said third and fourth air stream paths defining respective portions of said exhaust air  
path means between the intake and discharge sides of said exhaust air path means,  
said fresh air path means and said exhaust air path means being disposed and  
configured such that during a ventilation cycle,

exhaust air entering the exhaust air intake side flows through said third air  
stream path and then through said fourth air stream path and  
fresh entering said the fresh air intake side flows through said first air stream  
path and then through said second air stream path,

said ventilation apparatus including

a rotation component for inducing rotation of said exchanger wheel through said fresh  
air path means and said exhaust air path means,

defrost air path means for providing an air path by-passing said first air steam path, said  
defrost air path means comprising a defrost air discharge side and being configured to  
connect the exhaust air discharge side with the defrost air discharge side thereof for  
conveying defrost air to said defrost air discharge side from said exhaust air discharge

side,

and

a damper component, said damper component being displaceable between a ventilation configuration for a ventilation cycle

wherein said defrost air path means is closed off and said fresh air intake side and said exhaust air discharge side are open,

and a defrost configuration for a defrost cycle

wherein said fresh air intake side and said exhaust air discharge side are closed off and said defrost air path means is open,

and wherein

during a ventilation cycle, when said damper component is in said ventilation configuration,

fresh air is able to flow through said fresh air path means and exhaust air is able to flow through said exhaust air path means,

and

during a defrost cycle, when said damper component is in said defrost configuration,

defrost air taken from the building, is able to circulate, for delivery back into the building, through said exhaust air intake side, through said second air stream path, then through said defrost air path means, and through said defrost air discharge side.

52. A defrostable ventilation apparatus, for exchanging air between the interior and exterior of a building, for transferring water moisture and sensible heat between exhaust air taken from the building and fresh air taken from the exterior ambient air for



[illegible]

fresh entering said the fresh air intake side flows through said first air stream path and then through said second air stream path,

a rotation component for inducing rotation of said exchanger wheel through said fresh air path means and said exhaust air path means,

and

wherein said defrost air path means is closed off and said fresh air intake side and exhaust air discharge side are open,

wherein said fresh air intake side and said exhaust air discharge side are closed off, and said defrost air path means is open,

during a ventilation cycle, when said damper component is in said ventilation

configuration,

fresh air is able to flow through said fresh air path means and exhaust air is able to flow through said exhaust air path means,

and

during a defrost cycle, when said damper component is in said defrost configuration, defrost air taken from the building, is able to circulate, for delivery back into the building, through said exhaust air intake side, through said second air stream path, then through said defrost air path means, and through said fresh air discharge side.

00000277-112001